IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Wai Ming Choi	
Application No.:	10/822,440	Conf. #: 1434
Filed:	April 12, 2004	Group Art Unit: 1771
Entitled:	LOW DENSITY NONWOVEN GLASS FIBER WEB	Examiner: Andrew T. Piziali
Docket No.:	72545-83	

Certificate of Mailing (37 C.F.R. 1.8(a))

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Oct. 4, 2007 — Date of Signature and Mail Deposit

By: — Lisa Adams, Reg. No. 44,238, Attorney for Applicant(s)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

§1.132 Declaration of Wai Ming Choi

I, Wai Ming Choi, residing at 1569 Commonwealth Ave, West Newton, Massachusetts, hereby declare as follows:

1. I am a Chief Scientist at Hollingsworth & Vose Company, and my responsibilities include high efficiency glass fiber media development. I have been working at Hollingsworth & Vose Company for 14 years and I have been developing glass filter media grades for over 10 years.

2. I obtained a Master of Science degree in Chemical Engineering.

3. I have read the above-referenced application, and I fully understand the materials disclosed and claimed therein.

4. The above-referenced patent application is directed to a nonwoven filter media formed from glass wool fibers having a gamma value of at least about 14.

5. In the course of the research that resulted in the invention described and claimed in the above-referenced patent application, I set out to develop a glass filter media having a high gamma value. I prepared filter media using glass wool fibers, however when tested these filter media had gamma values of about 12-13. I unexpectedly discovered that adjusting the pH to an acidic pH, and then to a neutral pH during formation of the filter media resulted in a filter media having a gamma value of at least about 14, as explained in paragraphs 0023 and 0024 of the present application. In particular, the pH is adjusted by first adding an acidic agent to a slurry containing glass wool fibers, since glass wool fibers are anionic by nature. The acidic slurry is then adjusted by adding a neutral or alkaline pH adjusting agent to the slurry to bring the pH to a range of about 6 to 12. I discovered that this additional step of adding a neutral or alkaline pH adjusting agent to an acidic slurry unexpectedly produces a nonwoven glass web having improved filtration properties, and in particular having a gamma value of at least about 14.

6. The following examples prove that a gamma value of at least about 14 can only be obtained by performing two steps: (1) adjusting the pH of the slurry first to an acidic pH, and (2) then adjusting the pH to a neutral or alkaline pH.

Example A: No pH Adjusting Agents

Samples A1, A2, A3, A4, A5, and A6 are formed using the following process.

Water having a pH of about 6.0 is added to a Waring blender (which is equivalent to a pulper on a paper machine). Sulfuric acid (necessary for fiber dispersion) is added to the Waring blender. The pH is measured and recorded in Table A below as the "Blender pH." 4.18 grams Evanite 706X fiber having an average fiber diameter of about 0.69μ, 2.52 grams of Evanite 312X fiber having an average fiber diameter of about 4.2μ, 0.25 grams of Owens-Corning Chopped Glass fiber DE having an average fiber length of about 0.25 inches, and 0.25 grams of Owens-Corning Chopped Glass fiber DE having an average fiber length of about 0.5 inches are added to the blender and dispersed into a slurry. Water is added to a handsheet mold (equivalent to white

water tank during papermaking process), and the pH of the water is measured and recorded in Table A below as the "Mold pH." The slurry from the blender is added to the handsheet mold (equivalent to white water and fiber slurry being pumped into the headbox during the papermaking process), and the final pH of the water with the glass fiber slurry in the handsheet mold is measured and recorded in Table A below as the "Mold pH with Fiber Slurry" (this pH is equivalent to the pH in the headbox of the paper machine). The water from the handsheet mold is drained through a screen at the bottom of the mold. After the water is removed, a filter media is formed on top of the screen. The filter media is dried on a photo dryer to form a final filter media. The properties of each sample were tested and are shown in Table A below. All tests were conducted at an air velocity of 5.33 cm/sec with a DOP particle size of 0.3 microns.

Table A

Sample:	A1	A2	A3	A4	A5	A6
Blender pH	1.8	2	2.4	2.5	2.8	2.8
Mold pH with Water	6	6	6	6	6	6
Mold pH with Fiber Slurry	3.1	2.9	5.8	5.8	6.1	6.1
Basis Weight of Filter Media (g/m^2)	73.9	73.7	75.5	73.9	75.4	74.1
Filter Media Caliper (mm)	0.3175	0.41402	0.45466	0.43942	0.47752	0.44958
Filter Media Apparent Density (m2/g)	0.232756	0.178011	0.166058	0.168176	0.157899	0.16482
Filter Media Surface Area (m2/g)	1.5879	1.6585	1.6744	1.7911	1.7609	1.869
DOP Penetration (%)	0.027	0.022	0.009	0.0094	0.0036	0.0045
Air Resistance	26.4	27.4	28.8	29	30.8	31.3
Gamma	13.52	13.35	14.05	13.89	14.43	13.89

Example B: Acid Only

Samples B1, B2, B3, B4, B5, B6, B7, and B8 are formed using the following process.

Water having a pH of about 6.0 is added to a Waring blender. Sulfuric acid (necessary for fiber dispersion) is added to the Waring blender. The pH is measured and recorded in Table B below as the "Blender pH." 4.18 grams Evanite 706X fiber having an average fiber diameter of about

0.69μ, 2.52 grams of Evanite 312X fiber having an average fiber diameter of about 4.2μ, 0.25 grams of Owens-Corning Chopped Glass fiber DE having an average fiber length of about 0.25 inches, and 0.25 grams of Owens-Corning Chopped Glass fiber DE having an average fiber length of about 0.5 inches are added to the blender and dispersed into a slurry. Water is added to a handsheet mold (equivalent to white water tank during papermaking process), and sulfuric acid is added to the handsheet mold to adjust the pH, which is measured and recorded in Table B below as the "Acid Adjusted Mold pH with Water." The slurry from the blender is added to the handsheet mold (equivalent to white water and fiber slurry being pumped into the headbox during the papermaking process), and the final pH of the slurry in the handsheet mold is measured and recorded in Table B below as the "Mold pH with Fiber Slurry." The water from the handsheet mold is drained through a screen at the bottom of the mold. After the water is removed, a filter media is formed on top of the screen. The filter media is dried on a photo dryer to form a final filter media. The properties of each sample were tested and are shown in Table B below. All tests were conducted at an air velocity of 5.33 cm/sec with a DOP particle size of 0.3 microns.

Table B

Sample:	B1	B2	B3	B4	B5	B6	B7	B8
Blender pH	2.1	2	2.1	2.1	2.1	2.1	2	2.1
Acid Adjusted Mold pH with Water	2.4	2.4	3.1	3.3	4.2	4.2	5.3	5.2
Mold pH with Fiber Slurry	2.3	2.4	2.8	2.9	2.9	3.0	3.1	3.0
Basis Weight of Filter Media (g/m^2)	74	73.7	73.7	74.8	74.8	73.7	72.1	73.7
Filter Media Caliper (mm)	0.41402	0.40894	0.40132	0.41656	0.42418	0.42164	0.40386	0.41402
Filter Media Apparent Density (m2/g)	0.178735	0.180222	0.183644	0.179566	0.17634	0.174794	0.178527	0.178011
Filter Media Surface Area (m2/g)	1.7181	1.7905	1.7921	1.7650	1.7902	1.6750	1.6689	1.7488
DOP Penetration (%)	0.047	0.06	0.019	0.022	0.024	0.027	0.038	0.023
Air Resistance	26	25.1	27.9	27.5	26.9	26.5	26	27.3
Gamma	12.8	12.84	13.34	13.3	13.46	13.47	13.15	13.33

Example C: Base Only

Samples C1, C2, C3, C4, C5, and C6 are formed using the following process.

Water having a pH of about 6.0 is added to a Waring blender. Sulfuric acid (necessary for fiber dispersion) is added to the Waring blender. The pH is measured and recorded in Table C below as the "Blender pH." 4.18 grams Evanite 706X fiber having an average fiber diameter of about 0.69μ, 2.52 grams of Evanite 312X fiber having an average fiber diameter of about 4.2μ, 0.25 grams of Owens-Corning Chopped Glass fiber DE having an average fiber length of about 0.25 inches, and 0.25 grams of Owens-Corning Chopped Glass fiber DE having an average fiber length of about 0.5 inches are added to the blender and dispersed into a slurry. Water is added to a handsheet mold (equivalent to white water tank during papermaking process), and ammonium hydroxide is then added to the handsheet mold to adjust the pH, which is measured and recorded in Table C below as the "Base Adjusted Mold pH." The slurry from the blender is then added to the handsheet mold (equivalent to white water and fiber slurry being pumped into the headbox during the papermaking process), and the final pH of the slurry in the handsheet mold is measured and recorded in Table C below as the "Mold pH with Fiber Slurry." The water from the handsheet mold is drained through a screen at the bottom of the mold. After the water is removed, a filter media is formed on top of the screen. The filter media is dried on a photo dryer to form a final filter media. The properties of each sample were tested and are shown in Table C below. All tests were conducted at an air velocity of 5.33 cm/sec with a DOP particle size of 0.3 microns.

Table C

Sample:	C1	C2	C3	C3	C5	C6
Blender pH	2.5	2.3	2.5	2.5	2.4	2.4
Base Adjusted Mold pH with Water	7.1	6.9	8.0	8.1	9.0	9.0
Mold pH with Fiber Slurry	6.6	6.6	6.9	7.0	8.6	8.8
Basis Weight of Filter Media (g/m^2)	74.7	74.4	75.4	75.5	76.7	74.7
Filter Media Caliper (mm)	0.4699	0.45466	0.45974	0.4953	0.55372	0.54102
Filter Media Apparent Density (m2/g)	0.15897	0.163639	0.164006	0.152433	0.138518	0.138073
Filter Media Surface Area (m2/g)	1.8135	2.1247	1.8077	1.9059	1.8421	1.5920
DOP Penetration (%)	0.002	0.0037	0.0036	0.0029	0.0029	0.0015
Air Resistance	32.5	31.4	32.4	32.5	33.8	32.3
Gamma	14.46	14.11	13.72	13.96	13.42	14.93

Example D: Acid and Base

Samples D1, D2, D3, D4, D5, and D6 are formed using the following process.

Water having a pH of about 6.0 is added to a Waring blender. Sulfuric acid (necessary for fiber dispersion) is added to the Waring blender. The pH is measured and recorded in Table D below as the "Blender pH." 4.18 grams Evanite 706X fiber having an average fiber diameter of about 0.69μ, 2.52 grams of Evanite 312X fiber having an average fiber diameter of about 4.2μ, 0.25 grams of Owens-Corning Chopped Glass fiber DE having an average fiber length of about 0.25 inches, and 0.25 grams of Owens-Corning Chopped Glass fiber DE having an average fiber length of about 0.5 inches are added to the blender and dispersed into a slurry. Water is added to a handsheet mold (equivalent to white water tank during papermaking process), and sulfuric acid is added to the handsheet mold to adjust the pH, which is measured and recorded in Table D below as the "Acid Adjusted Mold pH with Water." Ammonium hydroxide is then added to the handsheet mold to adjust the pH, which is measured and recorded in Table D below as the "Acid/Base Adjusted Mold pH with Water." The slurry from the blender is then added to the handsheet mold (equivalent to white water and fiber slurry being pumped into the headbox during the papermaking process), and the final pH of the slurry in the handsheet mold is

measured and recorded in Table D below as the "Mold pH with Fiber Slurry." The water from the handsheet mold is drained through a screen at the bottom of the mold. After the water is removed, a filter media is formed on top of the screen. The filter media is dried on a photo dryer to form a final filter media. The properties of each sample were tested and are shown in Table D below. All tests were conducted at an air velocity of 5.33 cm/sec with a DOP particle size of 0.3 microns.

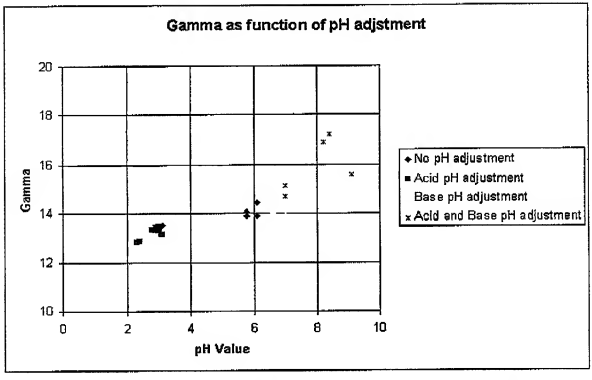
Table D

Sample:	D1	D2	D3	D4	D5	D6
Blender pH	2.4	2.4	2.4	2.5	2.4	2.4
Acid Adjusted Mold pH with Water	2.4	2.4	2.4	2.5	2.4	2.4
Acid/Base Adjusted Mold pH with Water	7.9	7.4	9	8.7	9	9.2
Mold pH with Fiber Slurry	7	7	8.2	8.4	8.9	9.1
Basis Weight of Filter Media (g/m^2)	74.5	76	75.4	76	76	76
Filter Media Caliper (mm)	0.48006	0.48514	0.52832	0.55118	0.54864	0.6096
Filter Media Apparent Density (m2/g)	0.155189	0.156656	0.142717	0.137886	0.138524	0.124672
Filter Media Surface Area (m2/g)	1.9521	2.009	1.8312	1.8009	1.9538	1.7098
DOP Penetration (%)	0.0048	0.003	0.0008	0.0007	0	0.0029
Air Resistance	29.4	29.9	30.2	29.9	31.1	29.1
Gamma	14.69	15.13	16.88	17.24		15.59

7. Figure 1 below shows the Gamma of the various filter media formed according to Samples A-D. As is clearly shown, the filter media formed accordingly to Sample D, which represent the claimed invention, have a much higher Gamma value than the filter media formed according to Samples A, B, and C. Thus, adjusting the pH of the slurry first to an acidic pH and then to a neutral pH clearly improves the gamma value of the resulting filter media. Sample D also shows a significant improvement in the apparent density and the surface area of the filter media as a direct result of adjusting the pH of the slurry first to acidic then to basic, as compared

to Examples A, B, and C.

Figure 1



8. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: 10/4/2007

Wai Ming Choi

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